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CLINICAL ARTICLE

Traumatic brain injuries in illustrated literature: experience from a series of over 700 head injuries in the Asterix comic books

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Abstract
Background The goal of the present study was to analyze the epidemiology and specific risk factors of traumatic brain injury (TBI) in the Asterix illustrated comic books. Among the illustrated literature, TBI is a predominating injury pattern.
Methods A retrospective analysis of TBI in all 34 Asterix comic books was performed by examining the initial neurological status and signs of TBI. Clinical data were correlated to information regarding the trauma mechanism, the sociocultural background of victims and offenders, and the circumstances of the traumata, to identify specific risk factors.
Results Seven hundred and four TBIs were identified. The majority of persons involved were adult and male. The major cause of trauma was assault (98.8%). Traumata were classified to be severe in over 50% (GCS 3–8). Different neurological deficits and signs of basal skull fractures were identified. Although over half of head-injury victims had a severe initial impairment of consciousness, no case of death or permanent neurological deficit was found. The largest group of head-injured characters was constituted by Romans (63.9%), while Gauls caused nearly 90% of the TBIs. A helmet had been worn by 70.5% of victims but had been lost in the vast majority of cases (87.7%). In 83% of cases, TBIs were caused under the influence of a doping agent called "the magic potion".
Conclusions Although over half of patients had an initially severe impairment of consciousness after TBI, no permanent deficit could be found. Roman nationality, hypoglossal paresis, lost helmet, and ingestion of the magic potion were significantly correlated with severe initial impairment of consciousness ($p \leq 0.05$).

Keywords Traumatic brain injury · Illustrated literature risk factors · Ancient Roman Empire · Asterix

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Introduction

"The year is 50 B.C. Gaul is entirely occupied by the Romans. Well, not entirely … one small village of the indomitable Gauls still holds out against the invaders. And life is not easy for the Roman legionaries who garrison the fortified camps of Totorum, Aquarium, Laudanum and Compendium … ." This legendary introduction introduces nearly all adventures of Asterix, the Gaulish warrior, and his inseparable friend Obelix, a menhir delivery-man. During their adventures, they have to defend their small village with its citizens against various enemies, first and foremost the Roman occupying power. A magic potion brewed by the village druid Getafix gives Asterix, Obelix and their fellow citizens superhuman strength, being the prerequisite for their continuing resistance. Among their adventures, several big and rather small battles, they thump Romans, pirates, and several other enemies, like Goths, or even themselves. Here, one might get the impression that severe and mild traumatic brain injury (TBI) is the predominant pattern of injuries, but a detailed analysis had not been performed hitherto.

Therefore, we performed a systematic retrospective analysis of occurrence of TBI among the Asterix comic

books to evaluate the prevalence, specific risk factors, and outcome of TBI.

Material and methods

All 34 Asterix comic books were screened for TBIs. For each head-injured character, a detailed neurological examination was estimated and signs of TBI, like raccoon eyes, Battle's sign, and subgaleal hematoma, were recorded by three authors (M.A.K., S.S.S., P.S.). Severity of TBI was classified by valuing head-injury victims' consciousness according to the Glasgow coma scale (GCS). TBI with a GCS above 12 were classified to be mild, while a GCS between 9 and 12 corresponds to a moderate TBI, and a GCS below 9 to a severe TBI. Furthermore, data about victims and perpetrators, their social positions and background and data regarding the trauma mechanism (blunt force, penetration of skull, etc.) were collected. Special attention was paid to the involvement of drugs ("the magic potion") on severity and outcome of TBI. Data were statistically analyzed using PASW, version 18.

Results

Among the 34 Asterix comic books analyzed, 704 cases of head or brain injury were identified. The vast majority of victims suffered repeated traumatic injuries in one or more comic books. Nearly all head-injured characters were male (99.1%; 698 males, six females) and adult. Traumatic brain injury was caused by blunt force in 696 cases (98.8%), while strangulation occurred in eight cases (1.1%). In particular, most figures suffered from assault (n=690, 98%) but few also from a fall. Therefore, trauma was classified to be adequate in most cases (n=689; 97.9%). However, the exact mechanism of brain injury remained unclear in four cases.

Clinical examination

The most common symptom of TBI was alteration of consciousness. Initially after trauma, the victims suffered from severe impairment of consciousness (GCS 3–8; http://www.asterix.com/encyclopedia/characters/goldenslumbus.html; Table 1) in 390 cases (55.4%), while initial GCS was between 9 and 12 in 89 cases (12.6%). Two hundred and twenty-five head-injury victims (31.9%) had no or only a slight alteration of consciousness (GCS 13–15). As a sign of the onset of cerebral herniation, extensor posturing or decerebrate posturing were observed in 13 cases (n= 1.8 %) and a pinhead-sized pupil as a sign of pontine compression in one case. Interestingly, no patient had a dilated pupil as a sign of elevated intracranial pressure

Table 1 Information about the head-injury mechanism, victims and perpetrators in the Asterix comic books

Trauma mechanism	
Blunt force	696
Assault	690
Fall	6
Strangulation	8
Adequate trauma	689
Victims	
Gender	
Male	698
Female	6
Female:male	1:117
Severity of trauma	
Mild trauma	225
Moderate trauma	89
Severe trauma	390
Ethnic background	
Extraterrestrials	4
Britons	5
Egyptians	2
Gaul	120
Goths	20
Indians	2
Native Americans	3
Normans	14
Bandits/pirates	59
Romans	450
Members of the Roman imperial army	414
Troopers	365
Commissioned officers	49
Swiss	4
Others	13
Vikings	8
Perpetrators	
Gender	
Male	686
Female	9
Female:male	1:76
Ethnic background	
Asterix and/or Obelix	402
Other Gauls	208
Belgians	3
Britons	6
Corsicans	2
Goth	14
Native Americans	2
Normans	2
Others	14
Romans	32
UUnclear	11
Vikings	2

(ICP). Beside alteration of consciousness, paresis of the hypoglossal nerve with an outstretched and sideward pointing tongue was frequently detected (n=188; 26.7%; http://www.asterix.com/encyclopedia/characters/goldenslumbus.html). Occurrence of hypoglossal paresis significantly correlated with more severe TBI (p=0.000). Furthermore, sporadic aphasia or amnesia occurred as neurological symptoms after TBI.

Visual inspection of the cranium frequently revealed periorbital ecchymoses (raccoon eyes, n=359; 50.9%; http://www.asterix.com/encyclopedia/characters/superfluous.html) as signs of basal skull fractures. In contrast, other evidence of basal skull fractures, like postauricular ecchymoses (Battle's sign), rhinorrhea or otorrhea of cerebrospinal fluid or laceration of the auditory canal, has not been observed. Examination further revealed subgaleal swelling in 71 victims (10%), but no signs of skull fractures or an open traumatic brain injury.

Sociocultural background of head-injury victims

Among the 704 identified cases of brain injury, the largest group was composed of Romans (n=450, 63.9%, Fig. 1a, Table 1). Thereof, most characters were members of the Roman imperial army (n=414), as troopers (n=365; 88.2%) or commissioned officers (n=49; 11.8%). Furthermore, 120 cases of head-injured Gaulish citizens were identified, as well as 21 head-injured pirates. The remaining head-injury victims had various sociocultural backgrounds, in that they were Belgians, Britons, Egyptians, Indians, native Americans, Normans, Swiss or Vikings (summarized in Fig. 1b). Also, four extraterrestrial characters suffered from TBI.

Not surprisingly, Gauls caused the vast majority of TBI (n=614, 87.1%). Alone, Asterix and Obelix were responsible for more than half of the detected TBIs (n=406, 57.6%). In contrast, 32 head injuries (4.5%) were caused by Romans and only one by a pirate.

Follow-up and outcome

Follow-up of characters was inconstant and ranged from a few minutes to approximately a couple of months. No case of death or a permanent neurological deficit following TBI has been found. Neurological deficits with aphasia and disorientation persisted longest in a case of a massive force

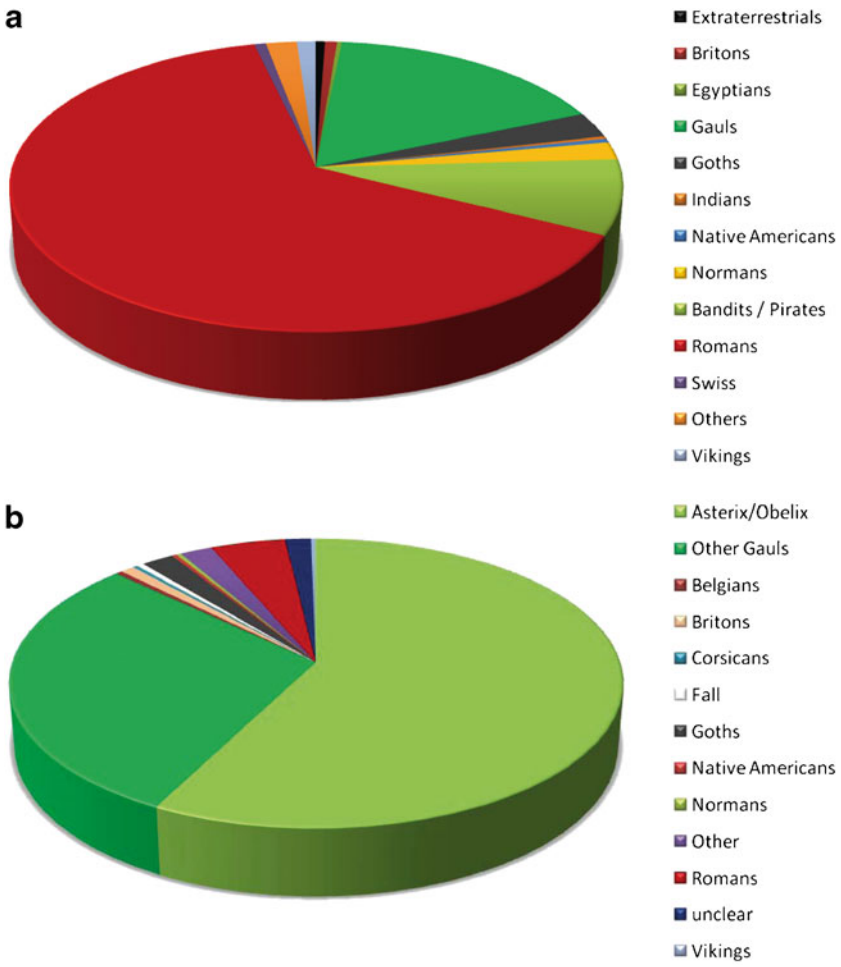

Fig. 1a, b Ethnic background of head-injury victims of assault and their aggressors. **a** Most head-injury victims in the Asterix comic books were Roman citizens. Additionally, Gauls, Belgians, Britons, Egyptians, Indians, native Americans, Normans, Swiss, Vikings and pirates also sustained head injuries. **b** In contrast, Gauls caused the vast majority of TBIs

onto the head of the druid Getafix and lasted for a period of several days to a couple of months (http://asteriximages.asterix.co.nz/books/bigfight/img7.htm). However, in general, all symptoms of TBI usually improved within a few minutes or hours.

Helmet

At the time of TBI, 497 of 704 characters wore a protection helmet (70.5%), but the vast majority of helmets got lost during the traumatic event (436/497 cases; 87.7%) and therefore may have been ineffective. In fact, loss of the helmet during trauma was associated with more severe traumata (p=0.000) and hypoglossal paresis (p=0.001) but not with a significantly higher occurrence of subgaleal swelling (p=0.822).

Involvement of drugs/doping agents

Before traumata, the majority of characters (n=588, 83.5%) causing TBI took the doping agent called "the magic potion". This substance contained mistletoe and was believed to give superhuman strength. In fact, characters who took the magic potion before traumata caused significantly more severe TBI with reduced level of consciousness (p=0.000) and a higher occurrence of the raccon eyes sign (p=0.47) but not with hypoglossal paresis (p=0.278). In addition, the magic potion was also used as medicine after TBI in a few cases (e.g., in "Asterix and the Great Divide", vol 25). Here, administration of the drug led to a prompt recovery of all symptoms, including impaired consciousness.

Discussion

Today, TBI is a leading cause of death in children and young adults. Overall, TBI-related mortality was estimated to be about 20–30% in various series [1, 2]. Among nonfatal cases, the percentages of TBI severity are typically mild in 80%, moderate in 10% and severe in 10% [1]. Common causes of TBI are falls, motor vehicle crashes, being struck by or against something, assault, and sport or firearm injuries [1-4].

In contrast, in the series of 705 head injuries presented here, over half of the head-injured comic-book characters had severe impairment of consciousness, with an initial GCS under 9. However, no case of death or a permanent neurological deficit has been found, while neurological symptoms usually completely improved within short time. In the vast majority, the cause of TBI was assault. The favorable outcome in the present series is astonishing, since outcome of TBI in the ancient word is believed to have been worse than today and also since no diagnostic or therapeutic procedures were performed. Although little is known about outcome and epidemiology of TBI in the year 50 B.C., ancient documents indicate limited diagnostic and treatment options. The first treatise giving insights in diagnostic and treatment of TBIs is the Edwin Smith Papyrus from ancient Egypt [5, 6]. Injuries estimated to be treatable were wounds without penetration of the skull and wounds combined with a circumscripted perforation of the skull, whereas severe TBIs, such as compound, displaced and depressed skull fractures or open traumata associated with laceration of dura and brain, were not accessible for a therapy in ancient Egypt. Hippocrates discussed trepanation as treatment for depressed fractures or evacuation of blood within the cranial cavity [7]. Analysis of the head injuries of Roman gladiators revealed that well-healed antemortem traumata were prevalent at the frontal region of the skull, whereas perimortem traumata were found at the parietal bones [8]. As one explanation, a relation of frontal traumata to the face-to-face position of Roman gladiators during the contest has been suggested [8]. Characters in the Asterix comic books stood in a face-to-face position during most assaults, which might contribute to the favorable outcome. Furthermore, over 70% of characters wore a helmet, which lowers expectation of fatal cranial injuries. The protective value of a helmet in reducing the risk of severe head injuries has been shown by several studies [9, 10]. However, since the helmet design of 50 B.C. was technically not as advanced as modern models and the helmets got lost in 90% of the injuries in the Asterix books, the protective effect was variable. Loss of helmet was associated with severe traumata and a higher risk of neurological deficits, like hypoglossal paresis.

Another explanation for the generally favorable outcome in the present study might be sought in deficits in the follow-up. In many cases, follow-up was only a few minutes. Here, a secondary deterioration after a "lucid interval" and development of intracranial hemorrhage might have been overlooked. However, most figures returned at later time points without any deficit.

Male gender, Roman sociocultural background, and loss of the helmet during traumata were risk factors for severe initial impairment of consciousness. Ethnic-specific differences in current TBI incidence have been described for Johannesburg, South Africa, the Bronx and the United States in general, where black people are more frequently involved in TBIs than whites [1]. Also, male gender is a known risk factor for TBI, and this relationship was extraordinarily high in our series [1].

Most of the Asterix TBIs were related to ingestion of a drug and doping agent called "the magic potion" by the aggressor. Ingestion of the magic potion by the aggressor was believed to give superhuman strength and was in fact associated with severe initial impairment of consciousness

of the victims. But the magic potion was also used in individual cases as a therapeutic drug, leading to complete improvement of neurologic symptoms. Although the exact formulation remained secret, it is known that the magic potion contained mistletoe. The mistletoe component, lectin, has been shown to have effects on brain tumors [11], but the role in the treatment of TBIs needs to be clarified by further studies.

Although over half of the patients had an initially severe impairment of consciousness after TBI, no permanent deficits could be found. Roman nationality, hypoglossal paresis, lost helmet, and ingestion of the magic potion by the aggressor were significantly correlated with severe initial impairment of consciousness. A limitation of the present study arises from the retrospective study design and the insufficient follow-up. Although the overall number of TBIs in the analyzed series appears to be large, the data are insufficient to answer all the questions. Expanding the database with the Asterix volumes possibly being published in the future may clarify a number of uncertainties.

Competing interest None declared

Conflicts of interest None.

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Comment

This manuscript relates to a very important—and unifying—issue in European history and socialization: the lecture of the Asterix comics. In addition to all sociocultural background information, be it on rites or on phenotypes of the involved tribes, which is provided with each of the journeys and with the endeavors of our heroes—being with them had always meant to be standing on the good side. And fighting against pretension of hegemony by the bad guys—be it on land or on water—has never been illustrated in a more decent, ironical, and sometimes hilarious manner. Most interestingly, according to the analysis provided by this paper, it was not that dangerous either, given the low rate of serious injuries, which were sustained by the Romans mainly. The role of helmet protection has been stressed by the authors, especially in view of the fact that strap-fixation should have been taken more seriously by the Roman besiegers and others. It would be interesting to compare the results from this comprehensive review of reported head injuries in all Asterix volumes with those of more recent heroes such as the Ducks or the Pink Panther and others, and to look at it with a possible transatlantic perspective. As this will have to wait, we are all reminded to keep our straps tightly fastened when reviving our own ever-adolescent endeavors from biking and down-hill skiing to football playing and others, as we have to acknowledge that head injury with all its potential sequels is amongst the greatest threats we have to be aware of nowadays, and children must be taught accordingly. Furthermore, and we must admit in all humility that traumatic brain injury is one of the fields of our specialty with everlasting importance and even rising numbers, a fact which should be considered when allocating manpower and funds for research. Meanwhile, the authors are to be commended for having undertaken this stimulating analysis.

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